

Chapter 4 Tunnel Design, Component Layout, Maintenance Scenario

4. 1 Linac

4. 1. 1 Tunnel Design

This LINAC tunnel is a building where accommodates the main body of this linear accelerator. The function that the radiation by the beam and the high frequency devices are sufficiently shielded is necessary. There is the sub-tunnel between the main tunnel and ground floor, to stand together radiation shield and wave-guide handling. The length of this tunnel is 303m(excluding L3BT), 15.7m depth from ground level and 7.1m width at the main part. The length of this tunnel is decided by optics design of the beam, the depth is required by the calculation of shielding effect and the width can allow cavities (ACS is largest) passing the side of the beam line devices. The wall thickness is limited by the radiation shielding effect, and the wall thickness is required 1.2m at the down stream. Then the wall of upper stream region should be thinner than 0.3m but the architectural requirement to endure the soil pressure makes the wall thickness 1.1m. The sub tunnel is established to ease the work of wave-guide settlement and to make bending structure that suppresses the radiation level. This sub tunnel is managed lower pressure, to have the function as the buffer for the radiation air leakage detection of the main tunnel. The birds view of the main tunnel is shown in fig.4.1.1-1. Cross sectional view at each section is shown in fig.4.1.1-2 and fig.4.1.1-3.

There are two large pits for the initial installation of cavities and magnets. One is near the ion source, and the other is at the cavity assembly hall. After installation, the pit of the cavity assembly hall is usually used for replacing devices. The width of the tunnel is the limit value able to take the cavities out without disassembling the beam line devices. For the DTL assembling, special area is prepared. There are two entrances for persons into the main tunnel with entrance control system, and one emergency door is usually locked. The sub tunnel has one entrance and four emergency doors.

The accelerator main body is settled in almost center of the tunnel section. The plumbing and rack are arranged to the right side toward the lower stream and the pathway is arranged the left side. Then the entrances approach from left side and utility tunnel pit comes down from right side.

4. 1. 2 Component Layout

The main body of LINAC is settled in the underground tunnel, and the high frequency devices are lined on the 1st floor. Wave-guide of each klystron comes down from 1st floor to the sub tunnel. The pit position on the sub tunnel floor has offset with the pit position of the ground floor for suppressing radiation streaming.

The klystron gallery is right above the main tunnel. The cooling water system, heat source boiler, DTQ magnets power supplies room and klystron preliminary room are arranged to both sides of the klystron gallery. The electricity trans-yards are put on the 2nd floor, and several parts of cooling water system components are put on the 2nd floor.

Device layout of upper stream region is shown in fig.4.1.2-1. Layout of other part is shown in

fig.7.1.1-1,fig.7.1.1-2 and fig.7.1.1-3.

4.1.3 Maintenance Scenario

It takes about one hour till the atmosphere radiation level falls off sufficiently, when this LINAC is operated in standard mode. After the stoppage of LINAC being confirmed through the procedure of the prescription, we can open the pits. This tunnel has two large pits, one is near the ion source and the other is between the ACS section and SCC section. When we have to take devices out from the tunnel, these pits are used.

The worker enters into the tunnel after the condition that shows it below being filled, in the case that the work in the tunnel is necessary. The condition of entering tunnel is that the radiation level is sufficient low, and the ventilation device are acting and that the result of the survey is prescription range inside. It is expected that the malfunction frequency of the ion source is highest. Procedure to minimize the leading time until starting again after maintenance around the injector section is now investigated.

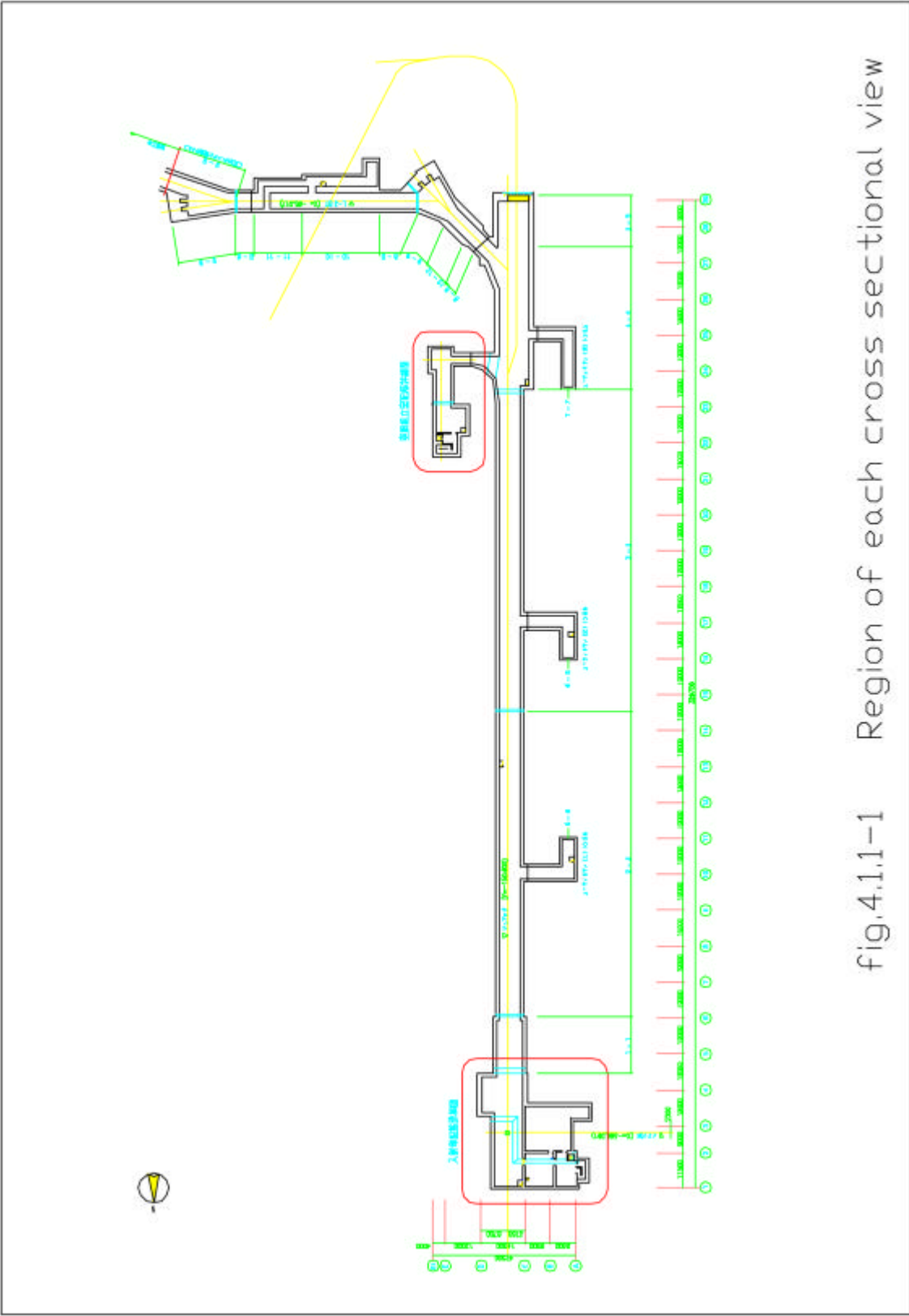


fig.4.1.1-1 Region of each cross sectional view

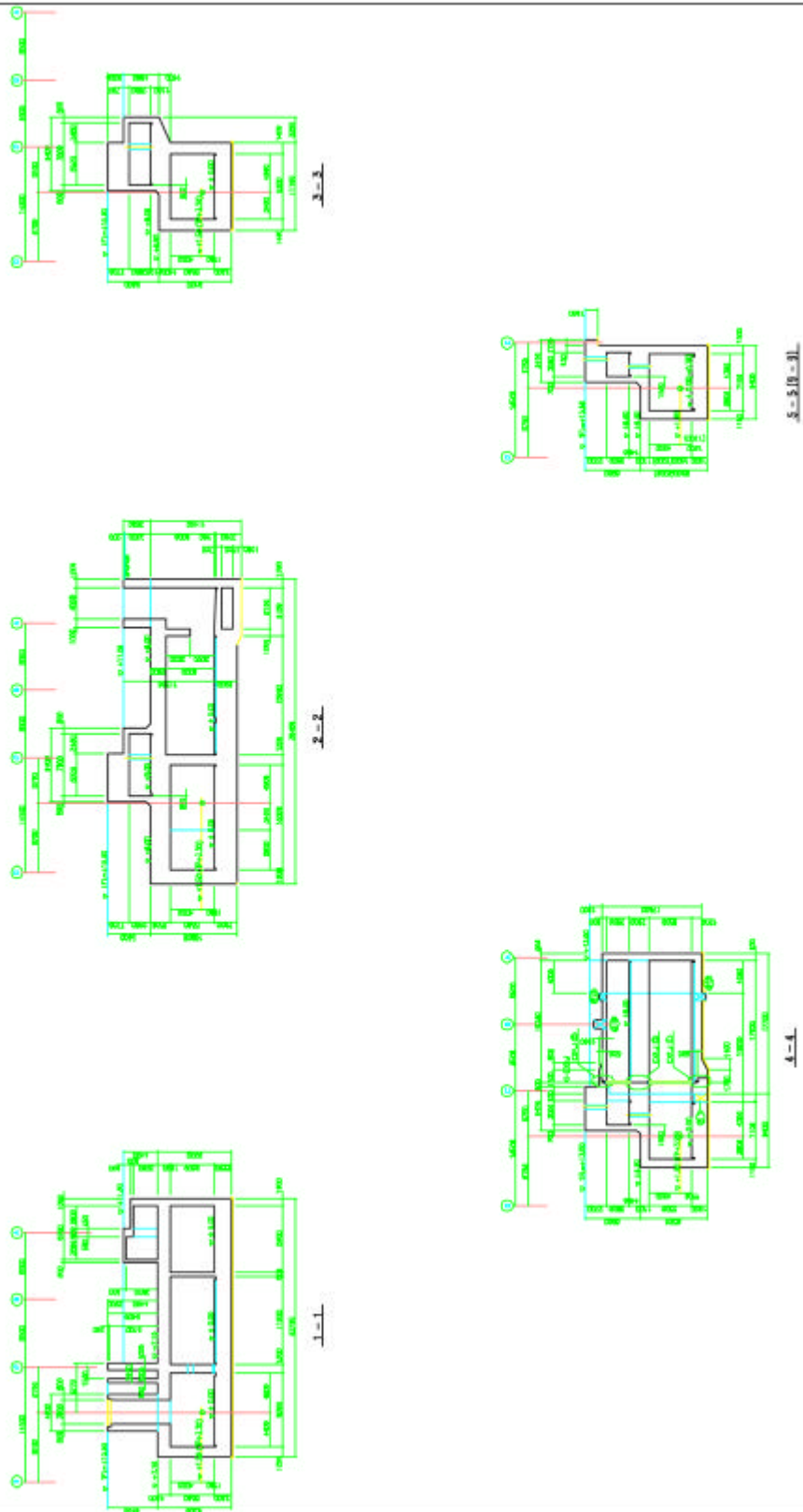


fig.4.1.1-2 Cross Sectional View of LINAC Tunnel (1)

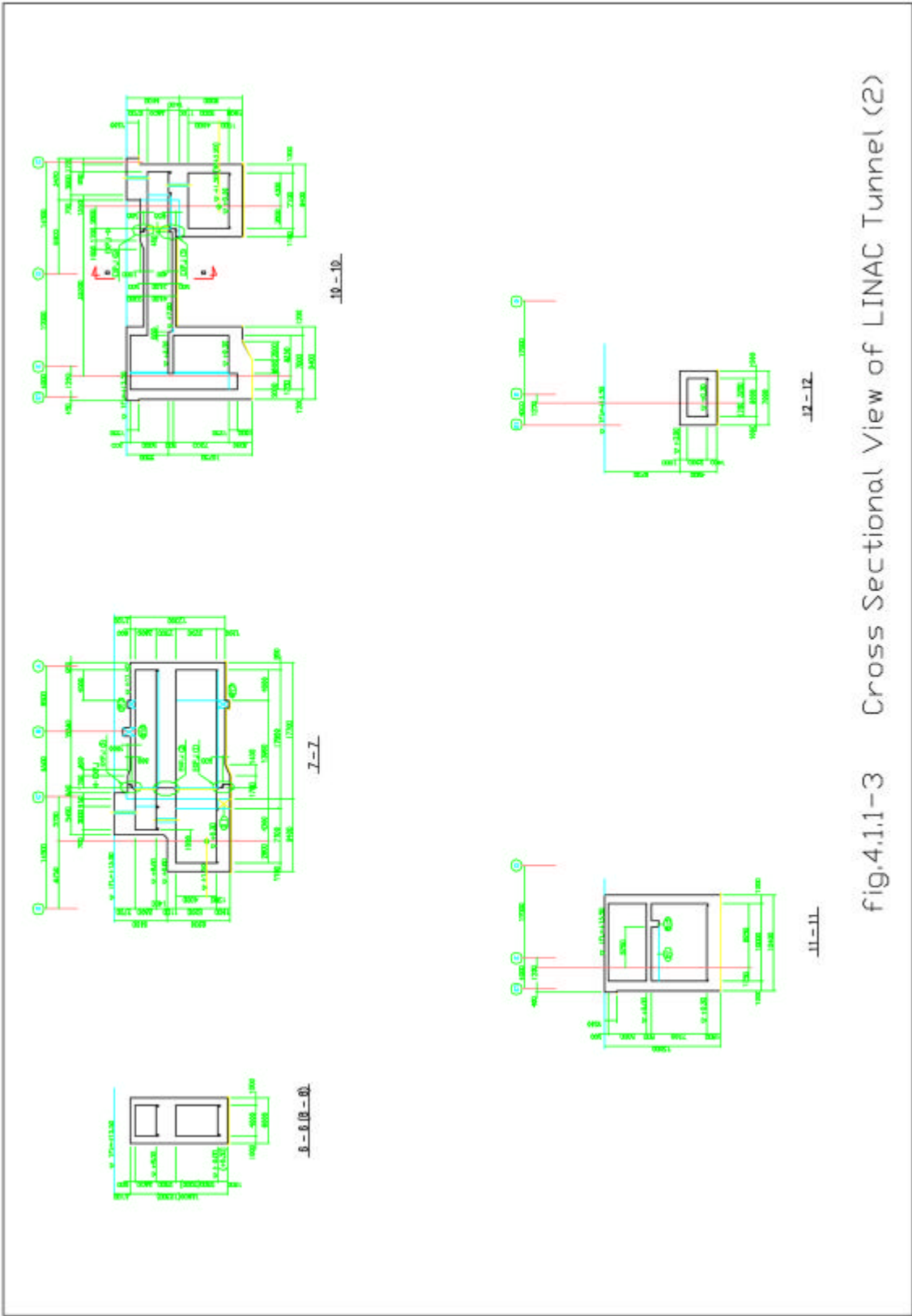


fig.4.1.1-3 Cross Sectional View of LINAC Tunnel (2)

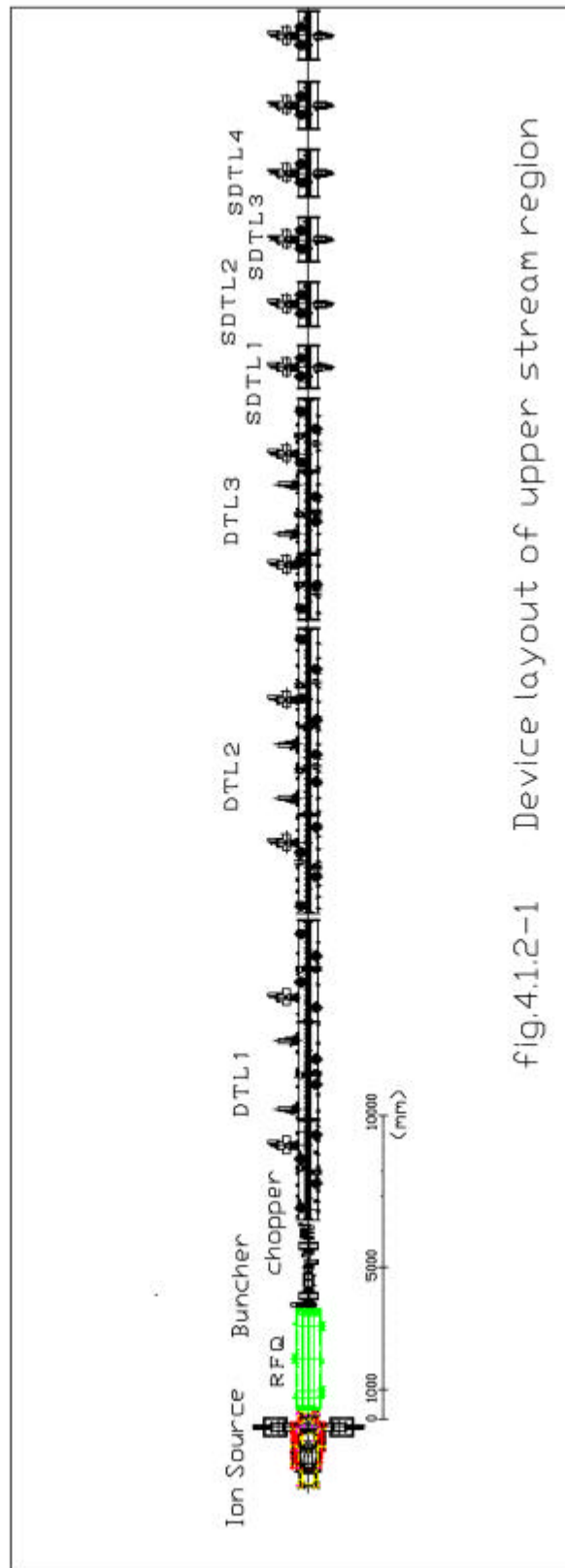


fig.4.1.2-1 Device layout of upper stream region